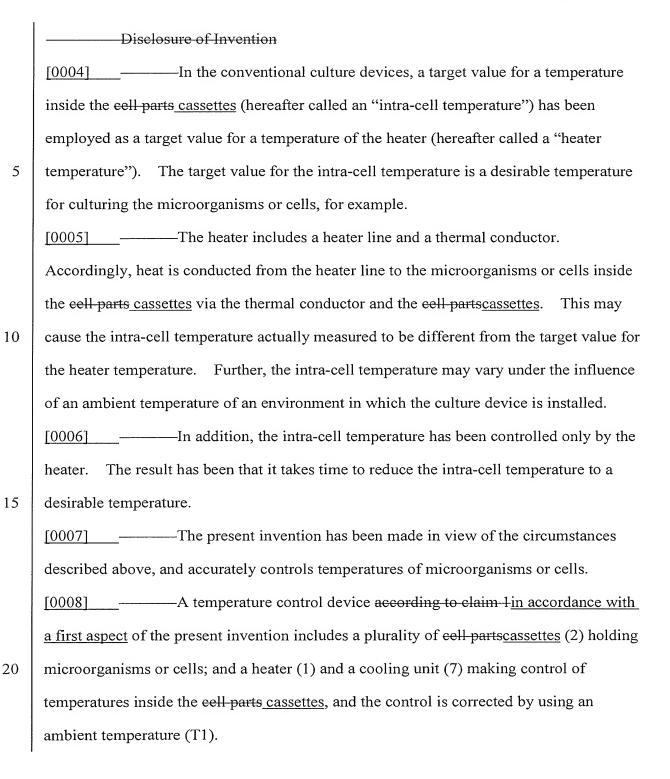
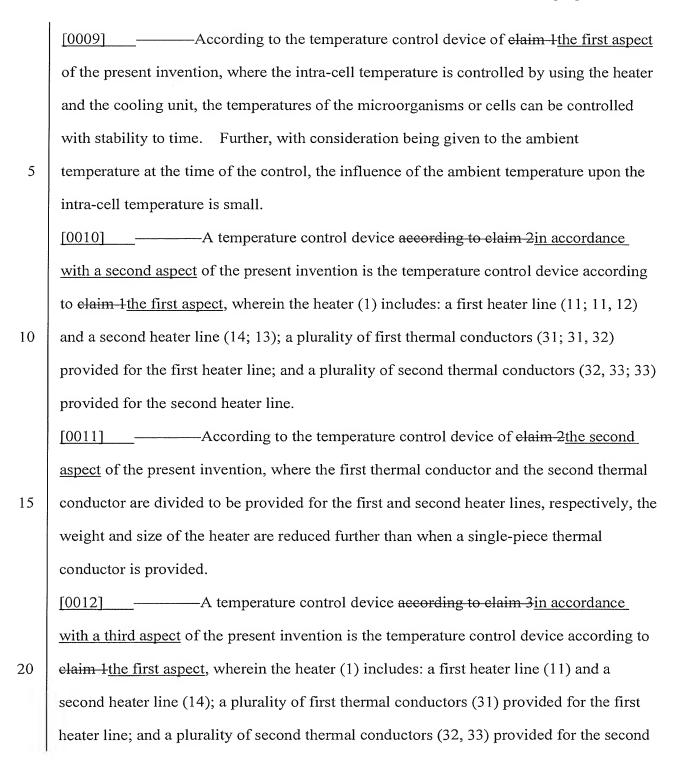
## **DESCRIPTION**

## TEMPERATURE CONTROL DEVICE

	Technical Field
5	The present invention relates to temperature control devices, and can
	be applied to culture and so on of microorganisms or cells, for example.
	[0001]
	Background Art
	[0002] ————A pace of culture and so on of microorganisms or cells is sensitive to
10	a temperature inside-a cell part a cassette. It is thus desirable to accurately control a
	temperature inside a cell part the cassette. Therefore, conventional culture devices
	include a plurality of eell parts cassettes, and a heater for heating the eell parts cassettes.
	The eell partscassettes hold microorganisms or cells.
	Non-patent document 1-"Food Bacteria Inspection System
15	DOX-60F/30F", [online], DAIKIN INDUSTRIES, LTD., [November 20, 2003], Internet
	<url:http: dox="" products="" www.del.co.jp=""> introduces a culture device for measuring the</url:http:>
	number of microorganisms or cells from a current flowing through a culture medium
	while culturing the microorganisms or cells.
20	DOX-60F/30F", [online], DAIKIN INDUSTRIES, LTD., [November 20, 2003], Internet
	<url:http: dox="" products="" www.del.co.jp=""></url:http:>
	[0003]
	SUMMARY OF THE INVENTION





heater line, and the first thermal conductor and the second thermal conductor are controlled to different temperatures from each other. [0013] ————According to the temperature control device of elaim-3the third aspect of the present invention, temperatures near the thermal conductors can be varied 5 for each heater, which allows concurrent culture and so on of microorganisms or cells under different conditions. with a fourth aspect of the present invention is the temperature control device according to elaim 1the first aspect, wherein the heater (1) includes: a first heater line (11, 12) and a 10 second heater line (13); a plurality of first thermal conductors (31, 32) provided for the first heater line; a plurality of second thermal conductors (33) provided for the second heater line; a first thermometer (41, 42) provided for one of the first thermal conductors; and a second thermometer (43) provided for one of the second thermal conductors, the first thermal conductors being equal in thermal capacity, the second thermal conductors being equal in thermal capacity, and the first thermal conductors and the second thermal conductors being different from each other in thermal capacity. aspect of the present invention, the first thermal conductors and the second thermal conductors are different in thermal capacity. This enhances a degree of freedom to arrange the first heater line and the second heater line to heat the plurality of eell parts cassettes uniformly. On the other hand, it is assumed that a temperature of the first thermal conductor measured by the first thermometer is almost equal to a temperature of the first thermal conductor not provided with the first thermometer. It is also assumed

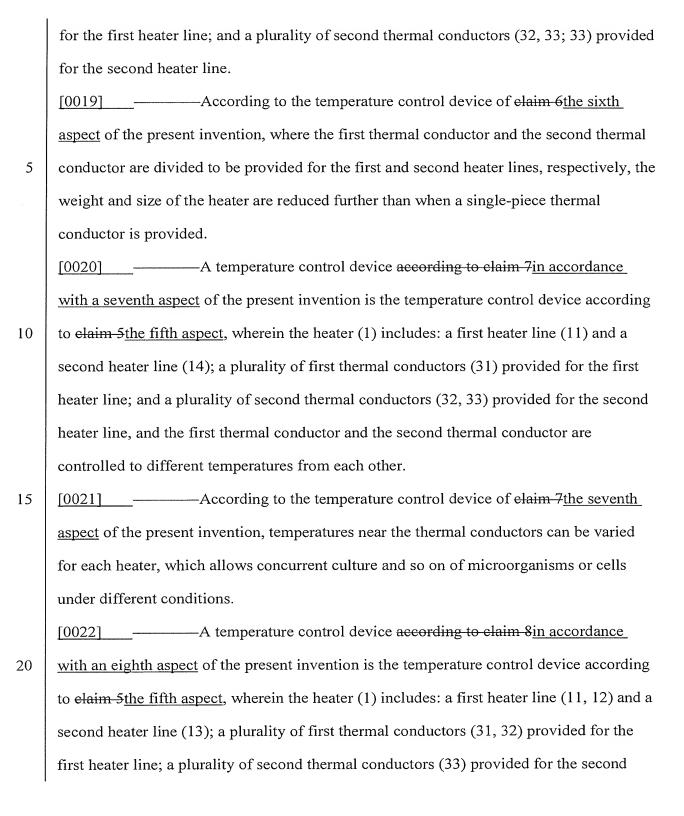
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that a temperature of the second thermal conductor measured by the second thermometer is almost equal to a temperature of the second thermal conductor not provided with the second thermometer. Accordingly, when controlling the first heater line and the second heater line by using the first thermometer and the second thermometer, temperatures near the first and second thermal conductors can be made almost equal. In short, the overall temperature of the heater can be made almost uniform. The result is that the temperature to which a pace of culture and so on of microorganisms or cells is sensitive can be controlled accurately. [0016] —————A temperature control device according to claim 5 in accordance with a fifth aspect of the present invention is the temperature control device according to elaim 1the first aspect, further including: a thermometer (45) measuring the ambient temperature (T1); a storage unit (5) storing calibration data; and a control unit (6) setting a target value (T0) for the temperatures inside the cell parts cassettes, and controlling the heater (1) and the cooling unit (7) with a second target value (T2) that is obtained based on the target value (T0) and the calibration data in accordance with the ambient temperature. [0017] ————According to the temperature control device of elaim-5the fifth aspect of the present invention, the second target value is set for each ambient temperature. The intra-cell temperature thus reaches the target value accurately. ————A temperature control device according to claim 6in accordance [0018] with a sixth aspect of the present invention is the temperature control device according to elaim 5the fifth aspect, wherein the heater (1) includes: a first heater line (11; 11, 12) and a second heater line (14; 13); a plurality of first thermal conductors (31; 31, 32) provided

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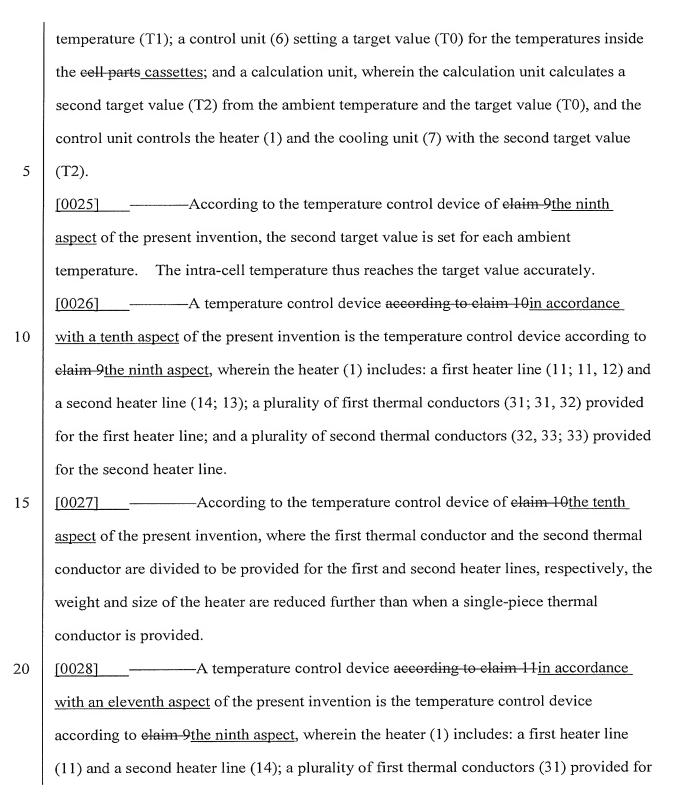
heater line; a first thermometer (41, 42) provided for one of the first thermal conductors; and a second thermometer (43) provided for one of the second thermal conductors, the first thermal conductors being equal in thermal capacity, the second thermal conductors being equal in thermal capacity, and the first thermal conductors and the second thermal conductors being different from each other in thermal capacity. [0023] ————According to the temperature control device of elaim 8the eighth aspect of the present invention, the first thermal conductors and the second thermal conductors are different in thermal capacity. This enhances a degree of freedom to arrange the first heater line and the second heater line to heat the plurality of eell parts\_ cassettes uniformly. On the other hand, it is assumed that a temperature of the first thermal conductor measured by the first thermometer is almost equal to a temperature of the first thermal conductor not provided with the first thermometer. It is also assumed that a temperature of the second thermal conductor measured by the second thermometer is almost equal to a temperature of the second thermal conductor not provided with the second thermometer. Accordingly, when controlling the first heater line and the second heater line by using the first thermometer and the second thermometer, temperatures near the first and second thermal conductors can be made almost equal. In short, the overall temperature of the heater can be made almost uniform. The result is that the temperature to which a pace of culture and so on of microorganisms or cells is sensitive can be controlled accurately. [0024] ————A temperature control device according to claim 9in accordance with a ninth aspect of the present invention is the temperature control device according to

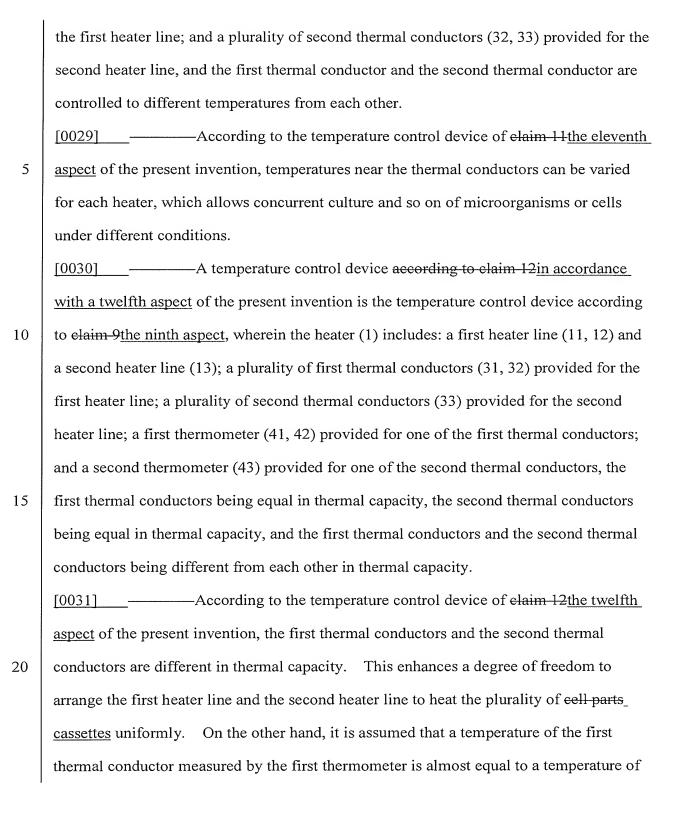
elaim—Ithe first aspect, further including: a thermometer (45) measuring the ambient

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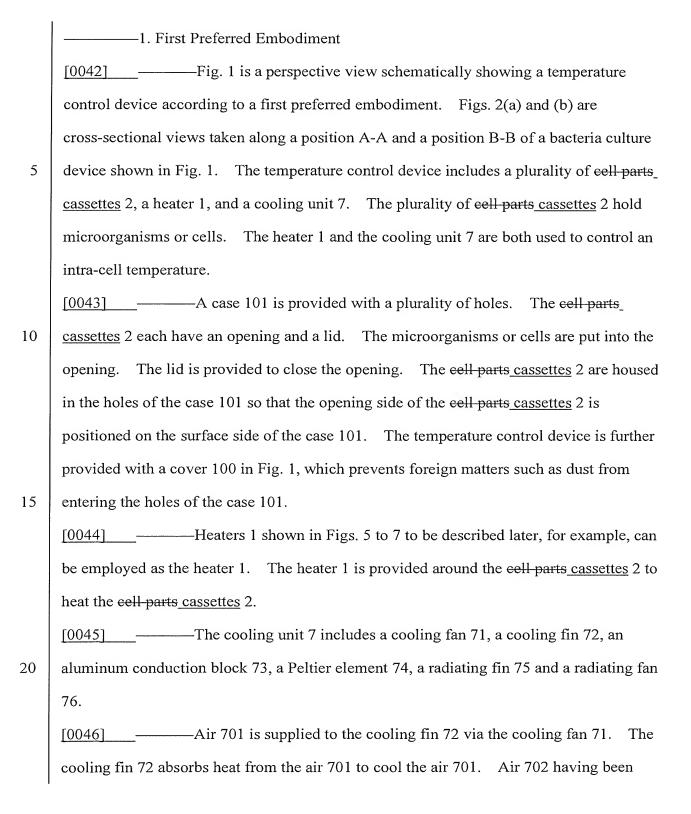
the first thermal conductor not provided with the first thermometer. It is also assumed that a temperature of the second thermal conductor measured by the second thermometer is almost equal to a temperature of the second thermal conductor not provided with the second thermometer. Accordingly, when controlling the first heater line and the second heater line by using the first thermometer and the second thermometer, temperatures near the first and second thermal conductors can be made almost equal. In short, the overall temperature of the heater can be made almost uniform. The result is that the temperature to which a pace of culture and so on of microorganisms or cells is sensitive can be controlled accurately. ———A temperature control device according to claim 13 in accordance with a thirteenth aspect of the present invention is the temperature control device according to elaim 12the twelfth aspect, wherein the second heater line (13) is provided on an outer edge side of the heater than the first heater line (11, 12) is, each of the first thermal conductors (31, 32) includes a pair of heat blocks (3) provided on both sides of the first heater line, and each of the second thermal conductors (33) includes one heat block (3) provided for the second heater line on the side of the first heater line. [0033] ————According to the temperature control device of claim 13the thirteenth aspect of the present invention, the number of heat blocks is reduced. Accordingly, the weight and size of the heater are reduced. [0034] ———A temperature control device according to claim 14in accordance with a fourteenth aspect of the present invention is the temperature control device according to any one of claims 1 to 13the first to thirteenth aspects, further including a

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	sensor for each of the <u>eell parts cassettes</u> (2), the sensor measuring a measurement value
	that varies depending on metabolism of the microorganisms or cells.
	[0035] ————According to the temperature control device of elaim 14the
	fourteenth aspect of the present invention, the number of microorganisms or cells is
5	estimated.
	———— These and other objects, features, aspects and advantages of the
	present invention will become more apparent from the following detailed description of
	the present invention when taken in conjunction with the accompanying drawings.
	[0036]
10	BRIEF DESCRIPTION OF DRAWINGS
	[0037] ———Fig. 1 is a perspective view schematically showing a temperature
	control device to be described in a first preferred embodiment.
	[0038] ——Figs. 2 are cross-sectional views taken along a position A-A and a
	position B-B of the temperature control device shown in Fig. 1.
15	[0039] ———Figs. 3 and 4 are block diagrams schematically showing
	control-correcting functions based on an ambient temperature.
	[0040] ———Fig. 5 is a plan view schematically showing a heater to be described
	in a second preferred embodiment.
	Figs. 6 and 7 are plan views schematically showing heaters to be
20	described in a third preferred embodiment.
	[0041]
	DESCRIPTION OF THE PREFERRED EMBODIMENTS
	Best Modes for Carrying Out the Invention

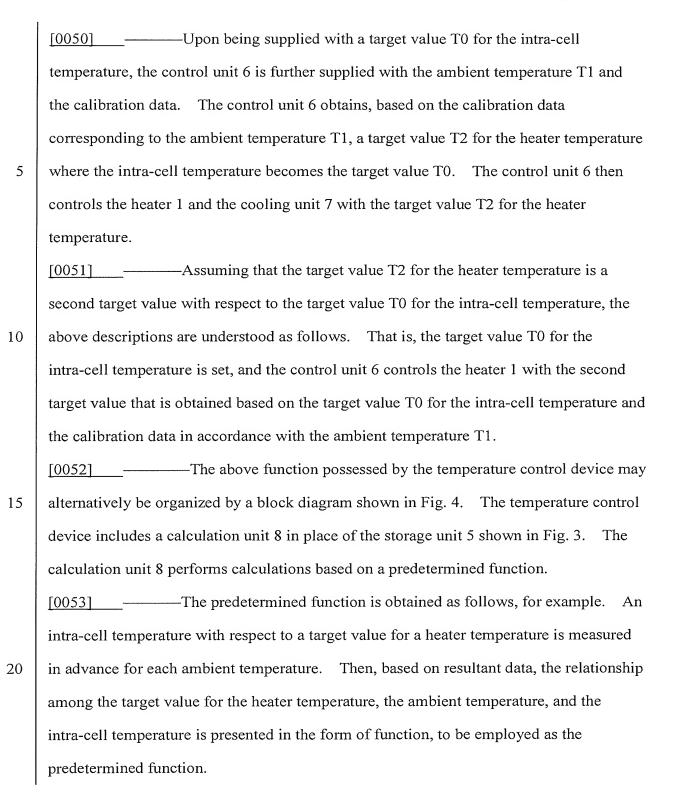


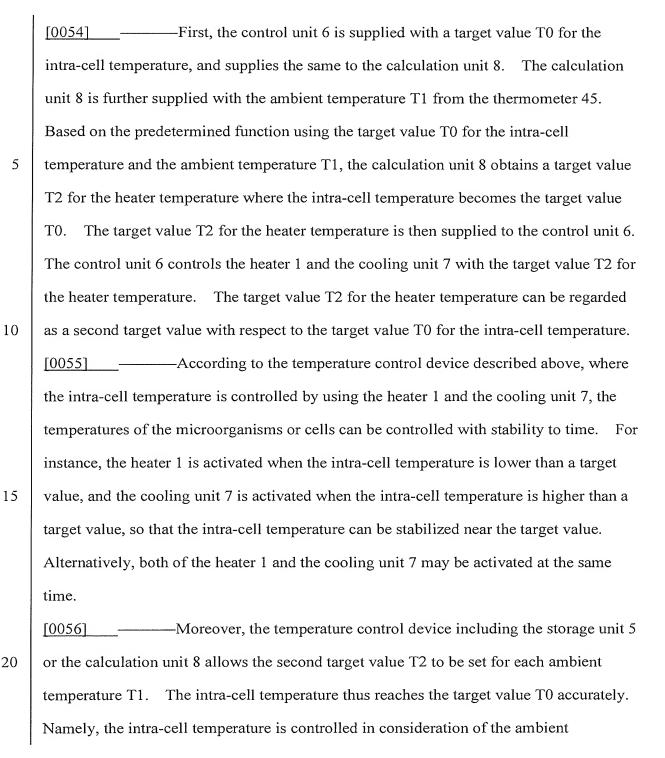
cooled is sent to the <u>eell parts cassettes</u> 2 to cool the <u>eell parts cassettes</u> 2. The flow of the air 701 and 702 is shown by the arrows in Figs. 2. In addition to the flow of the air 701 and 702 in the direction shown by the arrows in Fig. 2, the air 702 may be supplied to the cooling fan 71 via the cooling fin 72, to send the air 701 having been cooled to the cell-parts cassettes 2. [0047] \_\_\_\_\_The heat obtained by the cooling fin 72 is supplied to the aluminum conduction block 73. The Peltier element 74 moves the heat from the aluminum conduction block 73 side to the radiating fin 75 side. The heat having been moved to the radiating fin 75 is released to the outside by the radiating fan 76. [0048] ———The temperature control device corrects, based on an ambient temperature, control exercised by the heater 1 and the cooling unit 7, respectively. function possessed by the temperature control device is shown as a block diagram in Fig. 3, for example. The temperature control device further includes a thermometer 45, a storage unit 5 and a control unit 6. The thermometer 45 measures an ambient temperature T1. The storage unit 5 stores calibration data. The control unit 6 controls the heater 1 and the cooling unit 7, respectively. [0049] ———The calibration data is obtained as follows, for example. An intra-cell temperature with respect to a target value for a heater temperature is measured in advance for each ambient temperature. The target value for the heater temperature is set by the control unit 6, for example. Then, the relationship between the target value for the heater temperature and the intra-cell temperature is presented in the form of table for each ambient temperature, to be employed as the calibration data.

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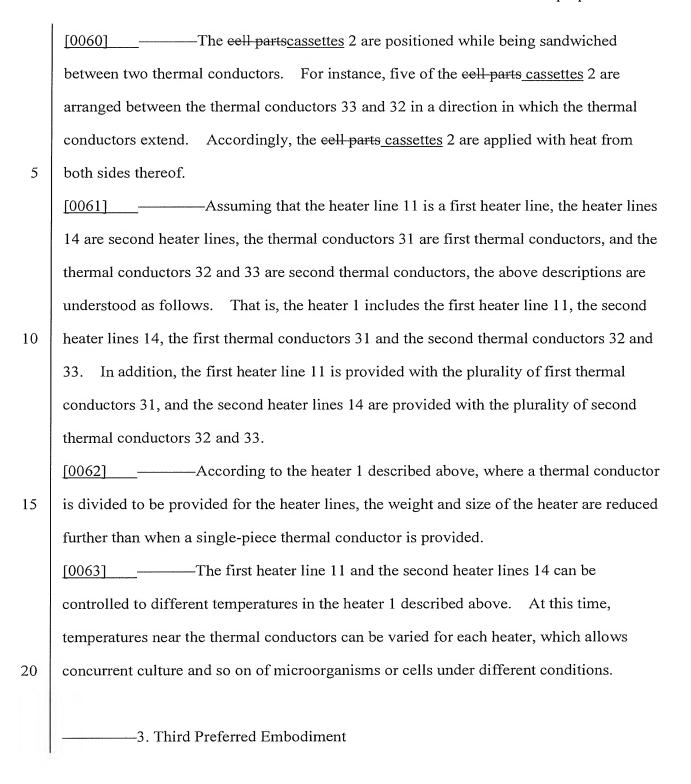
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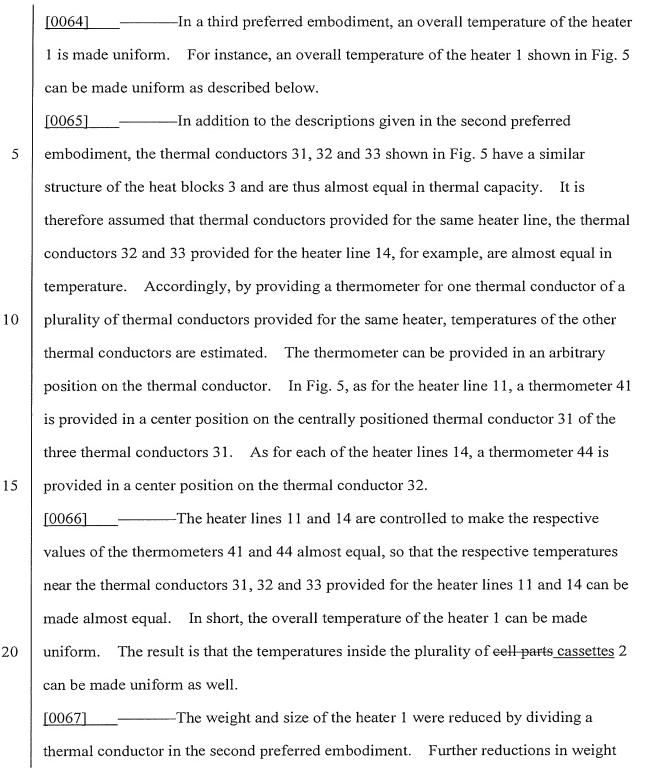
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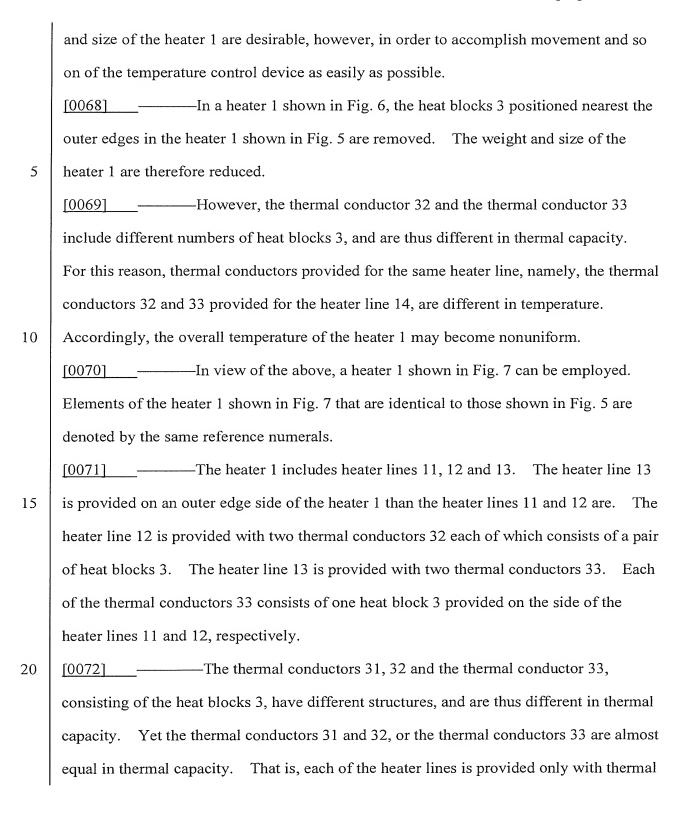




temperature, making the influence of the ambient temperature upon the intra-cell temperature small. [0057] ————The functions shown as the block diagrams in Figs. 3 and 4 can be organized by employing conventional techniques. For instance, a microcomputer can be 5 employed as the control unit 6. ——The temperature control device described above can be applied to other purposes than culture of microorganisms or cells. For instance, with microorganisms or cells as a medium, the amount, influence and the like of a chemical substrate can be measured by utilizing their respiration activities. Another application 10 would be when microorganisms or cells die out. [0058] 2. Second Preferred Embodiment [0059] ———Fig. 5 schematically shows a heater 1 according to a second preferred embodiment. Like the heater 1 according to the first preferred embodiment, this heater 1 can be applied to the temperature control device shown in the first preferred embodiment. 15 The heater 1 includes a heater line 11 and two heater lines 14. The heater lines 14 are provided on an outer edge side of the heater 1 than the heater line 11 is. The heater line 11 is provided with three thermal conductors 31, while the heater lines 14 are each provided with a thermal conductor 32 and a thermal conductor 33. Each of the thermal 20 conductors 31 consists of a pair of heat blocks 3 provided on both sides of the heater line 11. Likewise, the thermal conductors 32 and 33 each consist of a pair of heat blocks 3 provided on both sides of the heater line 14.







conductors that are equal in thermal capacity. A thermometer 42 is provided for one of the thermal conductors 32, and a thermometer 43 is provided for one of the thermal conductors 33. The thermometers 42 and 43 can be provided in arbitrary positions on the thermal conductors. In Fig. 7, as for the heater line 12, the thermometer 42 is provided in a center position on one of the thermal conductors 32. As for the heater lines 13, the thermometer 43 is provided in a center position on one of the thermal conductors 33.

\_\_\_\_\_\_Assuming that the heater line 11 (12) is a first heater line, the heater line 13 is a second heater line, the thermal conductors 31 (32) are first thermal conductors, the thermal conductors 33 are second thermal conductors, the thermometer 41 (42) is a first thermometer, and the thermometer 43 is a second thermometer, the above descriptions are understood as follows.

That is, the heater 1 includes the first heater line 11 (12), the second heater line 13, the first thermal conductors 31 (32), the second thermal conductors 33, the first thermometer 41 (42), and the second thermometer 43. The plurality of the first thermal conductors 31 (32) are provided for the first heater line 11 (12). The plurality of the second thermal conductors 33 are provided for the second heater line 13. The first thermometer 41 (42) is provided for one of the first thermal conductors 31 (32). The second thermometer 43 is provided for one of the second thermal conductors 33. The first thermal conductors 31 (32) are equal in thermal capacity, and the second thermal capacitors 33 are also equal in thermal capacity. The first thermal conductors 31 (32) and the second thermal conductors 33 are different from each other in thermal capacity.

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\_\_\_\_\_According to the heater 1 described above, the first thermal conductors 31 (32) and the second thermal conductors 33 are different in thermal capacity. This enhances a degree of freedom to arrange the first heater line 11 (12) and the second heater line 13 to heat the plurality of eell-parts cassettes 2 uniformly. For instance, the first heater lines 11 and 12 can be made into one first heater line provided with the thermal conductors 31 and 32. [0076] ——On the other hand, as the first thermal conductors 31 (32) are equal in thermal capacity, it is assumed that a temperature of the first thermal conductor 31 (32) measured by the first thermometer 41 (42) is almost equal to a temperature of the first thermal conductor 31 (32) not provided with the first thermometer 41 (42). Likewise, since the second thermal conductors 33 are equal in thermal capacity, a similar assumption can be made about the thermal conductor 33 not provided with the second thermometer 43. [0077] ———Accordingly, even when the first thermal conductors 31 (32) are different from the second thermal conductors 33 in temperature, the first heater line 11 (12) and the second heater line 13 are controlled by using the first thermometer 41 (42) and the second thermometer 43, so that the temperatures near the first thermal conductors 31 (32) and the temperatures near the second thermal conductors 33 can be made almost equal. In short, the overall temperature of the heater can be made almost uniform, making temperature distribution inside the plurality of eell parts cassettes 2 uniform. The result is that the temperature to which a pace of culture and so on of microorganisms or cells is sensitive can be controlled accurately.

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